3. Defining the Proposed and Standard Designs

The space conditioning energy budget for the low-rise residential Standards is a custom budget, that is, the energy that would be used by a building similar to the *Proposed Design*, but that is modified to just meet the requirements of the prescriptive standards. The building that is modeled to create the custom budget is the *Standard Design*. This section of the *ACM Approval Manual* describes how the *Proposed and Standard Designs* are defined.

The *Proposed Design* is modeled based upon user inputs that are subject to a variety of restrictions as well as a variety of fixed and restricted assumptions regarding dwelling design and operation. The user enters information to describe the thermal characteristics of the building envelope including its surface areas, air leakage, shading structures and attachments, thermal mass elements, heating and cooling equipment and distribution systems, and water heating equipment and distribution systems.

The process of generating the *Standard Design* and calculating the custom budget must be performed automatically by the program based on the allowed and default inputs for the *Proposed Design* as well as the fixed and restricted inputs and assumptions for both designs. These operations shall not be accessible to program users for modification when the program is used for compliance purposes or when compliance forms can be generated by the program. The *Standard Design* generator must automatically take user input about the *Proposed Design* and create input data for the *Standard Design*, using all the applicable fixed and restricted inputs and assumptions. All assumptions and algorithms used to model the *Proposed Design* must also be used in a consistent manner in the *Standard Design* building.

Defining the *Standard Design* building involves two steps. First, the geometry of the proposed building is modified from the description entered for the proposed design. Second, building features are modified to meet the minimum requirements of compliance with package D of the Standards.

The following sections present the details on how the *Standard Design* is to be developed.

3.1 Basis of the Standard Design - Package D

The basis of the *Standard Design* is package D. The requirements of package D are contained in Section 151(f) of Title 24, Part 6 of the State Building Standards. These prescriptive requirements are not repeated here.

3.2 Building Physical Configuration

Proposed Design: The building configuration is defined by the user entries for heavy and light floor areas, wall areas, roof and ceiling areas, fenestration areas, and door areas, which are entered along with the orientation of these building elements. The user entries for all of these building elements must be consistent with the actual building design and configuration. If the

ACM actually models the specific geometry of the building by using a coordinate system or graphic entry technique, the building geometry must be as consistent as reasonably possible with the actual building design to achieve thermal modeling accuracy.

Standard Design: The *Standard Design* building has the same floor area, volume, and configuration as the *Proposed Design*, except that wall and window area are distributed equally between the four main compass points, North, East, South, and West. The details are described below.

3.2.1 Conditioned Floor Area

Proposed Design: The ACM must require the user to enter the total conditioned floor area of the *Proposed Design* as well as the conditioned slab floor area. The conditioned slab floor area is the area of a slab floor with a minimum slab thickness of 3.5 inches or a minimum heat capacity of 7.0 Btu/ft^2-°F and conditioned space above and unconditioned space or the ground/gravel below. The non-slab conditioned floor area is the total conditioned floor area minus the conditioned slab floor area.

Standard Design: The total conditioned floor area and the conditioned slab floor area of the *Standard Design* building is the same as the *Proposed Design*.

Proposed Design & Standard Design: ACMs must keep track of the conditioned floor area and must at least be able to keep separate track of the total conditioned floor area and conditioned slab floor area. These areas are used to determine the default thermal mass for the *Proposed Design* and the thermal mass for the *Standard Design*. Stairwell floor area is the horizontal area of the stairs and landings between two floors of each story of the house. The conditioned slab floor area may be either on-grade or a raised slab.

3.2.2 Volume

Proposed Design: The volume of the *Proposed Design* is the conditioned volume of air enclosed by the building envelope. The volume must be consistent with the air volume of the actual design and may be determined from the total conditioned floor area and the average height or from a direct user entry for volume.

Standard Design: The volume of the *Standard Design* building is the same as the *Proposed Design*.

3.2.3 Ceilings

Proposed Design: The ACM shall allow a user to enter one or more ceiling/roof areas for the *Proposed Design* from an approved list of roof/ceiling construction types. Some of these construction types may be user-defined but the ACM must determine the output names for user-defined construction types for all building envelope constructions. The ACM shall not allow the user to specify output names for construction types or envelope elements. The roof/ceiling areas, construction assemblies, and tilts modeled must be consistent with the corresponding areas, construction assemblies, and tilts in the actual building design and must total the overall roof/ceiling area with conditioned space on the inside and unconditioned space on the other side. Except as indicated in the next sentence, the U-value of the modeled assembly must be the same as the U-value of the actual assembly. Ceiling construction assemblies that do not meet the mandatory minimum U-value required by Title 24 shall not be allowed.

Standard Design: The ceiling/roof areas of the *Standard Design* building are equal to the ceiling/roof areas of the *Proposed Design*. The *Standard Design* roof and ceiling surfaces are assumed to be horizontal (no tilts) and have a U-value specific to the package D requirements. The *Standard Design* generator must consider all exterior surfaces in the *Proposed Design* with a tilt less than 60 degrees as roof elements. Surfaces that tilt 60 degrees or more are treated as walls.

3.2.4 Radiant Barriers

Proposed Design: The ACM must allow the user to input a radiant barrier. The presence of a radiant barrier must be reported in the *Special Features and Modeling Assumptions* listings on the CF-1R and C-2R.

Standard Design: The *Standard Design* shall have a radiant barrier in accordance with Package D requirements.

3.2.5 Cool Roofs

Proposed Design: The ACM must allow the user to input a cool roof. The presence of a cool roof must be reported in the *Special Features and Modeling Assumptions* listings on the CF-1R and C-2R.

Standard Design: The *Standard Design* shall be modeled without a cool roof.

3.2.46 Walls

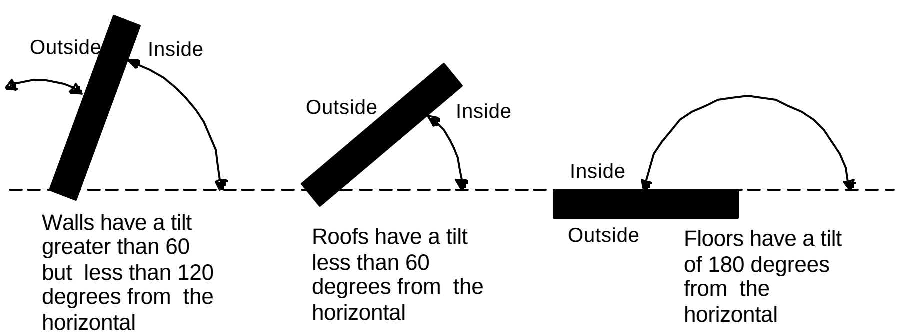

Figure 3-1 - Surface Definitions

Proposed Design: The ACM shall allow a user to enter one or more wall areas for the *Proposed Design* from an approved list of wall construction types. Some of these construction types may be user-defined but the ACM must determine the name for user-defined construction types for all building envelope constructions. The ACM shall not allow the user to specify names for construction types or envelope elements. The wall areas modeled must be consistent with the corresponding wall areas in the actual building design and the total wall area must be equal to the gross wall area with conditioned space on the inside and unconditioned space or exterior conditions on the other side.

Standard Design: The gross wall area in the *Standard Design* run is equal to the gross wall area of the *Proposed Design*, including knee walls in the ceiling construction of the *Proposed Design*. The gross wall area in the *Standard Design* is equally divided between the four main compass points, North, East, South, and West. Window and door areas are subtracted from the gross wall area to determine the net wall area in each orientation. All surfaces included in the *Proposed Design* run input file with a tilt from the horizontal of 60 degrees or more and less than 120 degrees are treated as walls. Surfaces that have a tilt of less than 60 degrees are considered to be roof surfaces.

3.2.~~5~~7 Basement Walls and Floors

Proposed Design: Portions of basement walls above grade must be modeled as conventional walls above grade. The user must be requested to enter the area of basement walls below grade as the area of below grade wall at each of 3 depths for Zero to 2 feet below grade (shallow), ~~from~~ greater than 2 feet to 6 feet below grade (medium), and greater than 6 feet below grade (deep). The ACM shall allow users to enter as many wall types as necessary to model the proposed construction. The ACM must use the same method for determining the U-value and mass characteristics for below grade walls as used for above grade walls. The default value for the proposed design wall construction shall be the same as the *Standard Design*.

Standard Design: The *Standard Design* shall have the same basement wall areas as the *Proposed Design*. The *Standard Design* basement wall shall be assumed to be a wall with a Heat Capacity of 15.7 Btu/(ft^2-°F), a thickness of 8 inches, and an uniform R-value of 1.5.

3.2.~~6~~8 Floors

Proposed Design: In addition to the total conditioned floor area and total conditioned slab floor area, ACMs must allow the user to enter floor areas for the standard raised floor construction types listed in Table 3-1 and at least three user-defined construction types. The ACM must require user input to be able to distinguish floor areas and constructions that are over crawl spaces. The ACM and its documentation must inform the user that the floor constructions and areas must be consistent with the actual building design.

The effect of a conventional crawl space is approximated with a thermal resistance of R-6; however, for controlled ventilation crawl spaces (an optional capability), the crawl space is modeled as a separate thermal zone and R-6 is not assumed. The R-6 value for a conventional crawlspace shall be automatically calculated by the ACM and shall not be allowed as a user input.

Standard Design: The exposed raised floor U-value used in the *Standard Design* is independent of the proposed construction assembly. It does vary, however, depending on whether or not the floor assembly is located over a crawl space. The ACM must keep track of which raised floor surfaces are over crawl spaces and which are not.

Proposed Design & Standard Design: The effect of a crawl space is approximated with a thermal resistance of R-6 and this is accounted for in the *Standard Design* U-value in Table 3-1. Raised floors in the *Proposed Design* that are not located over a crawl space shall not include the R-6 thermal resistance used for floors over a crawl space.

3.2.~~7~~9 Slab-on-Grade Perimeter

Proposed Design: The ACM must allow users to enter at least two different slab perimeter constructions and their corresponding lengths. ACMs must assume that 80% of any slab edge length entered is adjacent to rug-covered (R-2 for carpet and pad) slab and 20% is adjacent to exposed slab on the conditioned side and determine an overall F2 factor for the total length or specify that the user enter or choose such a weighted F2 factor. The ACM must be able to determine the amount of slab edge adjacent to unconditioned spaces separately from the slab edge adjacent to the outside so that the ACM can determine the appropriate *Standard Design*. In the *Proposed Design*, the F2 factor(s) may account for slab perimeter insulation for both slab edges exposed to the outside and slab edges adjacent to unconditioned spaces such as garages. Slab edges adjacent to garages and unconditioned spaces may be considered to be insulated with R-7 insulation and have an F2 factor of 0.51.

Standard Design: The total slab perimeter length in the *Standard Design* is the same as in the *Proposed Design*. For the *Standard Design*, the slab edge heat loss factor, F2, is 0.76 for all climate zones except Climate Zone 16 where F2 is 0.51. For the *Standard Design* unconditioned spaces such as the garage are assumed to be detached, hence the slab perimeter between conditioned spaces and unconditioned spaces such as garages is assumed to meet the Alternative Component Package D requirements in Section 151 of the building efficiency standards and is assumed to be exposed to the outside conditions. See Section 4.7.1 for details.

3.2.~~8~~10 Doors

Proposed Design: ACMs must allow users to enter at least two different door construction types, their areas, and orientations. These door types must include the standard door type specified in Table 3-1 plus at least one user-defined door type with an ACM specified name or designator. For the user-defined door type, the ACM must at least allow the user to enter the area, the orientation, and the U-value or R-value of the door.

Standard Design: The *Standard Design* has 40 square feet of door area for each dwelling unit. All doors are assumed to face north. This means that the net opaque wall area facing north is reduced 40 ft^2 for each dwelling unit for the *Standard Design* run.

3.2.~~9~~11 Fenestration Types and Areas

Proposed Design: ACMs must allow users to select fenestration or window types from the default tables in the standards or from several user-defined fenestration types where the user must enter the *Number of Fenestration Assemblies*, the *U-value* and *Solar Heat Gain Coefficient (SHGC)* for any user-defined window type. For each user-defined fenestration type the ACM must require the user to enter the Fenestration Area, tilt and orientation.

Standard Design: Fenestration area in the *Standard Design* is determined by the package D specification for the appropriate climate zone. If package D for the climate zone permits 20% of the conditioned floor area in glass, then the *Standard Design* has a fenestration area equal to 5% of the conditioned floor area facing in the direction of each major compass point. If package D for the climate zone permits 16% of the conditioned floor area in glass, then the Standard Design has a fenestration area equal to 4% of the conditioned floor area facing in the direction of each major compass point. There is no skylight area in the *Standard Design* run. The net wall area on each orientation is reduced by the fenestration area (and door area) on each facade.

3.2.~~10~~12 Overhangs

Proposed Design: ACMs must allow users to enter a set of basic generic parameters for a description of an overhang for each individual fenestration or window area entry. The basic parameters must include *Fenestration Height, Fenestration Width, Overhang Length, and Overhang Height.* ACM user entries for overhangs may also include *Overhang Left Extension* and *Overhang Right Extension.*

Standard Design: The *Standard Design* does not have overhangs.

3.3 Envelope Heat Loss Factors

Heat loss factors include U-values for ceilings/roofs, walls, floors, windows and doors. For the slab edges of slabs-on-grade the heat loss factor is expressed as an F2 factor

Proposed Design: Except for user-defined walls, ACMs must automatically assign heat loss factors based on the user's selection of one of the standard building elements from the approved lists of standard building elements.

ACM vendors should note that user entered U-values are developed with an outside air film resistance of 0.17 based on a 15 mph wind speed. The vendors may internally adjust the U-value in the simulation for average wind conditions (3 mph wind) by assuming an outside air film resistance of 0.38 or they may strip off the fixed outside air film R-value of 0.17 and calculate an hourly R-value for the outside air film coefficient based on the wind speed and surface roughness.

Standard Design: Heat loss factors in the *Standard Design* are determined by the Package D specification. They are independent of the construction assembly in the proposed building. The heat loss factors used in the *Standard Design* are given in the table below.

The *Standard Design* U-values for roof/ceilings and walls depends only on the package specification and is independent of the actual construction assembly proposed. The standard design U-values include an external air film with an R-value of 0.17 based on a 15 mile per hour wind speed. The adjustment to this air film for the standard design shall be the same as that used for the proposed design.

For slab edges, the heat loss factor (F2 factor) is one of two fixed values in the *Standard Design* run. For climate zones with no slab edge insulation requirement and slab edges adjacent to unconditioned spaces F2 is 0.76 and for slab edges required to be insulated it is 0.51. For the climate zone package(s) that require slab edge insulation (Climate Zone 16), the slab edge for the *Standard Design* has insulation on the total perimeter length and has an F2 factor of 0.51.

The door U-value is fixed at 0.330 Btu/(hr-ft^2-°F) in the *Standard Design* run.

Table 3-1 - Basecase Heat Loss Factors

Building Component	Package Specification or Mandatory Minimum	U-value
Roof	R-19	0.051
	R-30	0.034
	R-38	0.028
Wall	R-13	0.088
	R-19	0.065
	R-21	0.059
Raised Concrete Floor	R-0	
	R-4	
	R-8	
Raised Floor (crawl space)	R-19	0.037
(no crawl space)	R-19	0.049
Fenestration	U = 0.75	0.75
	U = 0.65	0.65
	U = 0.60	0.60
Doors	na.	0.330
		F2 Factor [1]
Slab Edge	None	0.76
	R-7	0.51

[1] The F2 Factor is determined based on the required assumption that 80% of the slab edge is adjacent to rug-covered slab and 20% is adjacent to exposed slab.

3.4 Solar Heat Gain Coefficients

Proposed Design: ACMs must require the user to enter the fenestration Solar Heat Gain Coefficient for each window, skylight, or other fenestration system type with a separate area. This requirement may be met by having the user select from a standard list of fenestration systems and sizes or by direct entry for user-defined windows or skylights. In addition, for each window, skylight and fenestration element the ACM must require the user to select an ~~interior and~~ exterior shading treatment from the lists given in ~~the tables below~~Table 3-3. The ACM will then determine the overall SHGC for the complete fenestration system based on the fenestration SHGC and the SHGCs assigned to the Commission-approved ~~interior and~~ exterior shading devices and assigned interior shading devices from Table 3-2 and Table 3-3.

Standard Design: The *Standard Design* fenestration Solar Heat Gain Coefficients (SHGCs) are determined by the appropriate Package D specifications for the applicable climate zone. Note that the frame type and the presence or absence of muntins or dividers is ~~now~~ irrelevant for the *Standard Design* ~~since~~ as the Package D values for $SHGC_{fen}$ and the ~~U-value~~ U-factor include the effects of fenestration features such as framing, dividers, and muntins.

3.5 Shading Devices and their Solar Heat Gain Coefficients

Internally, ACMs shall use two values to calculate solar heat gain through windows: $SHGC_{open}$ and $SHGC_{closed}$. $SHGC_{open}$ is the total solar heat gain coefficient of the fenestration and its exterior shading device when the operable interior shading device is open. $SHGC_{closed}$ is the total solar heat gain coefficient when the interior shading device is closed. $SHGC_{open}$ is the setting that applies when the air conditioner is not operating, which typically is most of the 24-hour period, while $SHGC_{closed}$ applies only for periods when the air conditioner operates. The *Standard Design* values for these SHGCs are shown in Table 3-4 below. $SHGC_{open}$ and $SHGC_{closed}$ are not user specified inputs.

The ACM must require the user to directly or indirectly specify $SHGC_{fen}$ and frame type. The ACM must assign an interior shading device as listed in Table 3-2 and require the user to specify ~~interior and~~ exterior shading devices as ~~the types~~ listed in ~~Tables 3-2 and 3-3~~Table 3-3. The ACMs must calculate the overall SHGC for the fenestration with shading devices as shown in Chapter 4.

For both the *Proposed Design* and the *Standard Design,* all windows are assumed to have ~~some type of interior shading (~~draperies and skylights are assumed to have no interior shading.~~)~~ ~~even if *NoRqmt* is specified for compliance purposes and none are present at final inspection. The ACM Compliance Supplement and the ACM output must indicate that interior shading devices or attachments other than *Drapes* that receive credit for solar heat gain reduction must be present at final inspection.~~ The ACM Compliance Supplement must also explicitly indicate that the ACM automatically gives credit for draperies for all windows ~~that do not use higher~~

~~performance interior shading devices~~ and that credit is allowed only for ~~one interior shading device and~~ one exterior shading device.~~ The default interior shading is a drapery which is given a fixed Solar Heat Gain Coefficient specified in the standards regardless of the type of drapery that might be installed. That is, no additional credit may be taken due to the color or weave density of draperies.~~

Proposed Design: The ACM must require the user to either accept the default exterior shading device~~s~~ or select from a specific Commission-approved list~~s~~ of ~~interior and~~ exterior shading devices for each fenestration element. The ~~default choice for~~ interior shading device is *Standard* ~~which uses the drapery SHGC of 0.68 specified in the Standards~~(0.68 SHGC) for windows and *None* (1.0 SHGC) for skylights. The default choice for exterior shading device is *Standard,* which is assigned an average SHGC of -0.76

Standard Design: The ACM uses the default values for interior and exterior shading devices for the *Standard Design* based on *Standard* for windows and *None* for skylights from Table 3-2 and Table 3-3.

Table 3-2 - Allowed Interior Shading Devices and Recommended Descriptors

Recommended Descriptor	Interior Shading Attachment Reference	~~Solar Heat Gain Coefficient before 1/1/20012~~	Solar Heat Gain Coefficient ~~after 1/1/2002~~
Standard	Draperies or No Special Interior Shading - Default Interior Shade	~~0.68~~	0.68 [1]
~~*Blind*~~	~~Venetian Blind, Vertical Blind or MiniBlind~~	~~0.47~~	~~0.47~~
~~*OpRollShd*~~	~~Opaque Roller Shades~~	~~0.47~~	~~0.68~~
None [2]	No Interior Shading - Only for Skylights (Fenestration tilt <60 degrees)	~~1.00~~	1.00

Note (general): No other interior shading devices or attachments are allowed credit for compliance with the building efficiency standards.

Note 1: ~~Default drapery~~ Standard shading shall be assumed for all fenestration with a tilt of 60 degrees or greater from horizontal~~whenever no other interior shading is specified for a window~~. ~~Output shall note that although *Standard* is specified, a drapery is modeled but is not required to be installed and present at final inspection . Output shall note for any interior shading device other than drapery that it must be installed and present at final inspection~~

Note 2: *None* ~~–~~is the default interior shading device in the standard and proposed design for fenestration tilted less than 60 degrees from horizontal (skylights) and is only allowed for fenestration tilted less than 60 degrees from horizontal (skylights)~~.~~, i.e. *None* is not an interior shading option for ordinary vertical windows.

Table 3-3 - Allowed Exterior Shading Devices and Recommended Descriptors

Recommended Descriptor	Exterior Shading Device Reference	Solar Heat Gain Coefficient
Standard	Bug Screen or No Shading - Default Bugscreens are modeled	0.76
WvnScrn	Woven SunScreen (SC<0.35)	0.30
LvrScrn	Louvered Sunscreen	0.27
LSASnScrn	LSA Sunscreen	0.13
RlDwnAwng	Roll-down Awning	0.13
RlDwnBlnds	Roll -down Blinds or Slats	0.13
None [1]	For skylights only - No exterior shading	1.00

Note 1: *None* –is the default for fenestration tilted less than 60 degrees from horizontal (skylights) and is only allowed for fenestration tilted less than 60 degrees from horizontal (skylights)., i.e. *None* –is not an exterior shading option for ordinary vertical windows.

Table 3-4 - *Standard Design* Shading Conditions

	Package Specification	
Characteristic	$SHGC_{fen}$ = NR	$SHGC_{fen}$ = 0.40
$SHGC_{fen}$	0.70	0.40
$SHGC_{open}$	0.68	0.39
$SHGC_{closed}$	0.63	0.37
Glazing	Double Clear	Double Clear
$SHGC_{fen+int}$	0.647	0.378
Interior Shade	Drapes (*Standard*)	Drapes (*Standard*)
$SHGC_{int}$	0.68	0.68
Exterior Shade	Bugscreen (*Standard*)	BugScreen (*Standard*)
$SHGC_{ext}$	0.76	0.76

3.6 Thermal Mass

The performance approach is based on prescriptive Package D of the efficiency standards, which has no thermal mass requirements. Package D and the performance approach assume that both the *Proposed Design* and *Standard Design* building have a minimum mass as a function of the conditioned area of slab floor and nonslab floor.

Proposed Design: The ACM may require the user to identify whether or not the *Proposed Design* is a high mass building that exceeds the specified mass threshold. Unless the *Proposed Design* has thermal mass that exceeds a thermal mass minimum threshold, the ACM shall model thermal mass for *the Proposed Design* the same as the *Standard Design*.

Standard Design: The ACM shall model the *Standard Design* as 20 percent of the *Proposed Design*'s conditioned slab floor area as exposed slab, 80% of the conditioned slab floor area as rug-covered slab, and 5% of the *Proposed Design*'s nonslab floor area as exposed 2 inch thick concrete. No other mass elements are modeled in the *Standard Design*.

The conditioned slab floor area (slab area) shall be modeled as 20 percent exposed thermal mass having a thickness of 3.5 inches, a volumetric heat capacity of 28 Btu/ft^3-°F, a conductivity of 0.98 Btu-in/hr-ft^2-°F, and a surface conductance of 1.3 Btu/hr-ft^2-°F (no thermal resistance on the surface). The remaining 80% of the conditioned slab floor area shall be modeled as covered thermal mass with the same characteristics as the exposed mass, but with the addition of a surface R-value of 2.0 Btu/hr-ft^2-°F typical of a carpet and pad.

Conditioned nonslab floor area shall be modeled with 5% of the nonslab floor area as exposed thermal mass. This thermal mass is modeled in both the *Proposed Design* and

Standard Design with a thickness of 2.0 inches, a volumetric heat capacity of 28 Btu/ft^3-°F, a conductivity of 0.98 Btu-in/hr-ft^2-°F, a surface conductance of 1.3 Btu/hr-ft^2-°F (no added thermal resistance on the surface).

3.7 High Mass Threshold

Proposed Design: The ACM may only allow the user to model additional thermal mass when the equivalent thermal mass for the *Proposed Design* reaches a specific mass threshold. The ACM may require that a user indicate a high mass design before the user is allowed to enter additional mass elements and mass characteristics other than what is assumed for the *Standard Design*. The high mass threshold is determined by an amount of mass equivalent to 30% of the conditioned slab floor area as exposed slab, 70% of the conditioned slab floor area as rug-covered slab and 15% of the conditioned nonslab floor area as 2 inch thick exposed concrete with the same specifications as those given in the ***Thermal Mass*** section above. To determine the threshold, this mass is converted to a standard Interior Mass Capacity using the Unit Interior Mass Capacity (UIMC) method described in Appendix I.

The thermal mass of the *Proposed Design,* other than the mass modeled for the *Standard Design* is only modeled and displayed on compliance output if the design has more equivalent thermal mass than the high mass threshold. The ACM may require that the user specify that the design is a high mass design before the entry of mass elements not related to the slab floor and nonslab floor defaults. For example, a *Proposed Design* with all of the conditioned floor area as slab-on-grade construction designed with 25% exposed slab is still modeled with 20% exposed slab because the designed thermal mass does not exceed the threshold. If the same house is designed with 30% of the conditioned floor area as exposed slab and 70% rug-covered slab then the permit applicant may model that amount of thermal mass in the *Proposed Design*. In addition, a *Proposed Design* may model and take credit for other forms of thermal mass such as masonry fireplaces or extra-thick sheetrock using the UIMC method to determine if the threshold mass is reached. Additional mass elements are not modeled in the *Standard Design*.

Standard Design: The *Standard Design* thermal mass is the same as described in Section 3.6.

3.8 Heating and Cooling System

Proposed Design: ACMs must require the user to enter simple heating and cooling seasonal efficiencies that are used to characterize basic package single zone HVAC systems used to heat and/or cool the modeled building. ACMs must be able to distinguish what fuel is being used to heat the building and what fuel is used to cool the dwelling. This may be based on direct user input or indirectly determined from the user's selection of HVAC equipment types. ACMs must require the user to enter the type of distribution system that is used in the proposed design.

Standard Design: The standard heating and cooling system for central HVAC systems is a single zone system with ducts in the attic. The standard heating and cooling system for non-central HVAC systems is an unducted system.

3.8.1 Heating Equipment

Proposed Design: ACMs must be able to model the basic types of heating equipment listed in Table 2-3 except for combined hydronic space and water heating systems, which is an optional modeling capability. ACMs must require the user to enter the basic information to model the energy use of these pieces of equipment. At the minimum this includes some type of seasonal efficiency for heating and whether or not the HVAC system has ducts. When using a gas heating system, the ACM must require the user to identify if the gas heating system is ducted or non-ducted and if it is a central gas furnace or gas heat pump system, or a non-central gas furnace system. If the system is a non-ducted non-central gas furnace system, the ACM must require the user to select the type and size of the equipment from Table 3-5 where the system size, as a default, may be determined as 34 Btu/hour per square foot of conditioned floor area. For central ducted systems the ACM *Proposed Design* shall use Equation 3.2 for gas furnaces, 3.4h for gas heat pumps, and 3.3 for electric heat pumps and electric resistance furnaces.

Table 3-5 - Non-Ducted Non-Central Heating Equipment Default Efficiencies

Gas Fired Wall Furnaces, Floor Furnaces and Room Heaters			*Seasonal Efficiency*
Wall	fan type	up to 42,000 Btu/hour	73%
		over 42,000 Btu/hour	74%
	gravity type	up to 10,000 Btu/hour	59%
		over 10,000 Btu/hour up to 12,000 Btu/hour	60%
		over 12,000 Btu/hour up to 15,000 Btu/hour	61%
		over 15,000 Btu/hour up to 19,000 Btu/hour	62%
		over 19,000 Btu/hour up to 27,000 Btu/hour	63%
		over 27,000 Btu/hour up to 46,000 Btu/hour	64%
		over 46,000 Btu/hour	65%
Floor		up to 37,000 Btu/hour	56%
		over 37,000 Btu/hour	57%
Room		up to 18,000 Btu/hour	57%
		over 18,000 Btu/hour up to 20,000 Btu/hour	58%
		over 20,000 Btu/hour up to 27,000 Btu/hour	63%
		over 27,000 Btu/hour up to 46,000 Btu/hour	64%
		over 46,000 Btu/hour	65%

Standard Design: When electricity is used for heating, the heating equipment for the *Standard Design* shall be an electric heat pump with a Heating Seasonal Performance Factor (HSPF) of 6.8 except when *Proposed Design*s use a single package heat pump only, the *Standard Design* shall assume an HSPF of 6.6. When electricity is not used for heating, the equipment used in the *Standard Design* building shall be either a gas furnace with an Annual Fuel Utilization Efficiency (AFUE) of 0.78 for central systems, or shall be a gas furnace of the type specified in the proposed design at the efficiency level shown in Table 3-5 for non-central systems. If the *Proposed Design* has both electric and fossil-fuel-fired heating equipment types, the standard system shall be based on the floor area weighted Source Seasonal Efficiency (SSE). In calculating the weighted average SSE, the efficiencies of all heating equipment and distribution systems are converted to source seasonal efficiencies (SSE), as shown in Equations 3.~~1~~2 and 3.~~2~~3.

Seasonal air distribution efficiencies ($\eta_{dist,\ seasonal}$) for the *Proposed Design* and the *Standard Design* shall be calculated using the procedures and algorithms in Appendix F and Equation 3.1. The seasonal distribution efficiencies for the *Standard Design* shall be calculated using the defaults specified in Appendix F. The seasonal distribution system efficiency shall be calculated using the seasonal delivery effectiveness ($DE_{seasonal}$), the equipment efficiency factor (F_{equip}), and the thermal recovery factor (F_{recov})

$$h_{dist,\,seasonal} = 0.98 \times DE_{seasonal} \times F_{equip} \times F_{recov}$$

$$h_{dist,\,seasonal} = DE_{seasonal} \times F_{equip} \times F_{recov}$$ Equation 3.1

$$SSE_{gas\ with\ fan} = \left(\frac{1 + (0.005 \times 3.413)}{\left\{ \frac{1}{AFUE} \right\} + (0.005 \times 10.239)} \right)_h h_{dist.seasonal} = 0.7628 \times h_{dist,\,seasonal}$$

$$SSE_{\text{gas withfan}} = \left(\frac{1 + (0.005 \times 3.413)}{\frac{1}{AFUE} + (0.005 \times 10.239)} \right) \times h_{dist,seasonal}$$ Equation 3.2

$$SSE_{electric} = \left(\frac{HSPF}{10.239} \right) \times h_{dist,\,seasonal}$$ Equation 3.3

$$SSE_{\text{GasHeatPump,Heating}} = \frac{h_{dist,seasonal}}{\left[\frac{1}{COP_{heatinggas}} + \frac{3}{COP_{heatingelectric}} \right]}$$ Equation 3.4h

3.8.2 Cooling Equipment

Proposed Design: ACMs must be able to model the basic types of cooling equipment listed in Table 2-43. ACMs must require the user to enter the basic information to model the energy use of these pieces of equipment. At the minimum this includes some type of seasonal distribution system efficiency for cooling, identification of whether the cooling system is ducted or non-ducted and central or non-central. If the cooling system is non-ducted non-central, the ACM must require the user to select the type and size of the equipment from those shown in Table 3-6. The efficiencies of all electric cooling equipment and distribution systems are converted to source seasonal energy efficiency ratios (SSEER), as shown in Equations 3.2c and 3.3c. The efficiencies of all gas cooling equipment and distribution systems are converted to source seasonal efficiency as shown in Equations 3.4c. Packaged air conditioning systems (PkgAirCond, LrgPkgAirCond, PkgHeatPump or LrgPkgHeatPump) shall be noted in the Special Features and Modeling Assumptions listings.

Table 3-6 - Non-Ducted Non-Central Cooling Equipment Default Efficiencies

Room Air Conditioner Type		Cooling Capacity	Energy Efficiency Ratio
Reverse Cycle	Side Louvers		
Without	with	less than 6,000 Btu	8.0
		6,000 to 7,999 Btu	8.5
		8,000 to 13,999 Btu	9.0
		14,000 to 19,999 Btu	8.8
		20,000 and more Btu	8.2
	without	less than 6,000 Btu	8.0
		6,000 to 7,999 Btu	8.5
		8,000 to 13,999 Btu	8.5
		14,000 to 19,999 Btu	8.5
		20,000 and more Btu	8.2
With	with	All	8.5
	without	All	8.0

Standard Design: If a packaged ducted central air conditioner (*PkgAirCond* or *LrgPkgAirCond*) or ducted central packaged heat pump (*PkgHeatPump* or *LrgPkgHeatPump*) is used for the *Proposed Design*, the cooling system used in the *Standard Design* building shall be a single package air conditioner (*PkgAirCond* or *LrgPkgAirCond*) with an SEER (seasonal energy efficiency ratio) of 9.7. Otherwise, the cooling system for the *Standard Design* building with a central system shall be a split system central air conditioner *(SplitAirCond)* with an SEER of 10.0. For non-ducted non-central cooling equipment, the efficiencies shall be as shown in Table 3-6 for the type and size in the *Proposed Design* where the size may be a user input or shall default to 24 Btu per hour per square foot of conditioned floor area. In the case of *NoCooling* for the *Proposed Design*, the cooling system for the *Standard Design* building shall be a split system air conditioner (*SplitAirCond*) with an SEER of 10.0. When a *Proposed Design* uses both a split system air conditioner and another type of air conditioner, the *Standard Design* SEER shall be a conditioned floor area weighted average of the equivalent SEER of the cooling equipment. The efficiencies of all electric cooling equipment and distribution systems are converted to source seasonal energy efficiency ratios (SSEER), as shown in Equations 3.2c and 3.3c. The efficiencies for gas cooling equipment and distribution systems are converted to source seasonal efficiency ($SSE_{GasHeatpumCooling}$) as shown in Equation 3.4c

Seasonal air distribution efficiencies ($\eta_{dist,\ seasonal}$) for the *Proposed Design* and the *Standard Design* shall be calculated using the procedures and algorithms in Appendix F. The seasonal distribution efficiencies for the *Standard Design* shall be calculated using the defaults specified in Appendix F. The seasonal distribution system efficiency shall be calculated using the seasonal delivery effectiveness ($DE_{seasonal}$), the equipment efficiency factor (F_{equip}), and the thermal recovery factor (F_{recov})

Source seasonal energy efficiency ratios for the *Standard Design* shall be calculated as shown in Equations 3.1c, 3.2c and 3.3c.

$$\eta_{dist,seasonal} = 0.98 \times DE_{seasonal} \times F_{equip} \times F_{recov} \qquad \text{Equation 3.1c}$$

$$SSEER_{\text{central,ducted}} = SEER_{temperature} \times F_{install} \times F_{TXV} \times \eta_{dist,seasonal} \qquad \text{Equation 3.2c}$$

$$SSEER_{\text{other}} = SEER \times \eta_{dist,seasonal} \qquad \text{Equation 3.3c}$$

$$SSE_{\text{GasHeatPump,Cooling}} = \frac{F_{install} \times F_{TXV} \times \eta_{dist,seasonal}}{\left[\dfrac{1}{COP_{coolinggas}} + \dfrac{3}{COP_{coolingelectric}}\right]} \qquad \text{Equation 3.4c}$$

The temperature adjusted SEER ($SEER_{temperature}$) adjusts the performance of the cooling equipment at typical outdoor air temperatures by climate zone depending on the SEER rating. For *SplitAirCond*, *PkgAirCond*, *SplitHeatPump*, *PkgHeatPump*, $SEER_{temperature}$ shall be interpolated from Table 3.6c. Extrapolation shall not be used with this table. Equipment with a SEER below 8 shall use the value for 8. Equipment with a SEER above 18 shall use the value for 18. For all other central ducted equipment, $SEER_{temperature}$ shall be equal to the EER rating.

Table 3.6c -- Temperature adjusted SEER ($SEER_{temperature}$) by Climate Zone

	SEER										
CZ	8	9	10	11	12	13	14	15	16	17	18
1	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
2	7.79	8.75	9.71	10.67	11.52	12.25	12.96	13.65	14.34	15.00	15.66
3	7.82	8.78	9.75	10.72	11.59	12.37	13.13	13.89	14.63	15.36	16.08
4	7.82	8.78	9.75	10.72	11.59	12.37	13.13	13.89	14.63	15.36	16.08
5	7.94	8.92	9.91	10.90	11.86	12.78	13.70	14.61	15.53	16.44	17.34
6	7.98	8.98	9.98	10.97	11.96	12.94	13.92	14.90	15.88	16.85	17.83
7	7.95	8.94	9.93	10.92	11.89	12.83	13.77	14.71	15.65	16.58	17.52
8	7.72	8.67	9.62	10.57	11.38	12.05	12.70	13.34	13.97	14.60	15.21
9	7.57	8.49	9.41	10.33	11.04	11.53	12.00	12.45	12.89	13.31	13.72
10	7.44	8.33	9.23	10.13	10.76	11.11	11.44	11.76	12.07	12.36	12.64
11	7.38	8.27	9.16	10.04	10.64	10.94	11.22	11.48	11.74	11.99	12.22
12	7.43	8.33	9.22	10.12	10.74	11.08	11.41	11.72	12.01	12.29	12.56
13	7.35	8.23	9.11	10.00	10.57	10.83	11.08	11.31	11.53	11.74	11.95
14	7.16	8.01	8.85	9.70	10.16	10.24	10.31	10.38	10.45	10.51	10.58
15	7.17	8.02	8.87	9.71	10.18	10.26	10.34	10.41	10.48	10.54	10.61
16	7.78	8.74	9.70	10.65	11.51	12.24	12.97	13.68	14.39	15.09	15.79

The installation factor ($F_{install}$), which adjusts for typical installation practice where refrigerant charge and airflow are not at design values, shall be 0.852.

The ~~thermostatic expansion valve (TXV)~~ refrigerant charge and airflow factor (F_{TXV}), which adjusts the system performance to account for the presence of a TXV, shall be 1.0 for systems without a TXV. For systems with a TXV, the ~~themostatic expansion valve~~ refrigerant charge and airflow factor shall be 1.07 for duct systems designed according to ACCA Manual D and 1.11 for all other duct systems.

3.8.3 ~~Thermostatic Expansion Valves~~Refrigerant Charge and Airflow

Proposed Design: The ACM must allow the user to enter a central ducted cooling system with a refrigerant charge and airflow option~~thermostatic expansion valve (TXV)~~. Thise option requires either measuring charge and airflow using procedures set forth in Appendix K (for split system equipment only) or requires the presence of a thermostatic expansion valve (TXV). These features require~~s~~ verification by the HERS rater and must be reported in the *Special Features and Modeling Assumptions and HERS Required Verification* listings on the CF-1R and C-2R.

Standard Design: Standard Design: If a split system ducted central air conditioner or heat pump (*SplitAirCond* or *SplitHeatPump*) is used for the *Proposed Design* then the cooling system used in the *Standard Design* building shall have either refrigerant charge and airflow measurement or be equipped with a thermostatic expansion valve if required by Package D.

Adjustments to the source seasonal energy efficiency ratio due to refrigerant charge and airflow measurement or thermostatic expansion valves are described in section 3.8.2.

3.8.~~3~~4 Ducts and HVAC Seasonal Distribution System Efficiency for Ducted Systems

Proposed Design: As a default, HVAC ducts for ducted systems are assumed to exist and are located in the attic. Likewise, as a default, the air handler is assumed to be located in the attic. Proposed HVAC systems with a duct layout and design on the plans may locate the ducts in the crawlspace or a basement if the layout and design specify that all of the supply registers are located in the floor and show the appropriate locations for the ducts. When all of the supply registers are located in the floor or all of the supply registers are located in the ceiling, the ACM can use Table 4.1 of Appendix F to allocate the duct surface areas. If all supply registers are in the floor, but the building has both a crawlspace and a basement, the duct location may be taken as a floor area weighted average of the entries in Table 4.1 of Appendix F. If any story of a building has supply registers in both the floor and more than two feet above the floor, the duct location for that story must be modeled as 100% ducts in the attic. If the modeled duct location for a given story is not in the attic, the ACM must specify that all supply registers for that story of the building (or the whole building) are located in the floor in the *Special Features and Modeling Assumptions* listings for special verification by the local enforcement agency.

Proposed HVAC systems with a complete ACCA Manual D design including the duct layout and design on the plans may allocate duct surface area in more detail in the ACM model but the distribution of duct surface areas by location must appear on the *HERS Required Verification* list for verification by a HERS rater.

In a similar fashion, the supply duct surface area (and the location of the ducts) of an ACCA Manual D designed duct system may be modeled explicitly in the ACM and receive energy efficiency credit. When a non-default supply duct surface area is modeled, the supply duct surface area is subject to verification by a HERS rater and must be listed on the *HERS Required Verification* listings. The HERS rater must also verify the existence of the ACCA Manual D design and layout and the general consistency of the actual HVAC distribution system with the design. The HERS rater must also measure and verify the fan flow and confirm that it is consistent with the ACCA Manual D design specifications.

The ACM shall allow users to specify if they will be using diagnostic testing of HVAC distribution efficiency of a fully-ducted system by a HERS rater during the construction of the building to confirm the modeling of improved HVAC distribution efficiency measures such as duct leakage. The default shall be that no diagnostic testing will be done. Duct efficiency credits may not be taken and diagnostic testing may not be done on any HVAC system that uses building cavities such as plenums or a platform return. If the user does not select diagnostic testing, the ACM shall require users to input at least two (2) basic parameters to determine HVAC distribution efficiency: the total conditioned floor area of the building as specified above and the R-value of the duct insulation which may be defaulted to R4.2. Additional data may be required to determine seasonal distribution system efficiency~~,~~. ~~t~~The default input parameters are presented in Appendix F. If the user specifies diagnostic testing to be performed during construction, the ACM shall request the user to enter the data described in Section 4.19~~8~~, *Duct Efficiency* and shall report all required measurements and the features used to achieve higher HVAC distribution efficiencies in the *HERS Required Verification* listings. When the user chooses diagnostic testing, the diagnostic testing shall be performed as described in Appendix F. Diagnostic testing must be reported in the *HERS Required Verification* listings on the CF-1R and C-2R as described in Chapter 2.

Standard Design: The standard heating and cooling system for central systems is assumed to have air distribution ducts located in an attic space, 6~~22~~% total tested duct leakage, non-ACCA Manual D designed duct system, and ~~no~~ a radiant barrier in climate zones where required by Package D. R-4.2 duct insulation is assumed for the *Standard Design* building. The *Standard Design* building is assumed to have the same number of stories as the *Proposed Design* for purposes of determining the duct efficiency. HVAC distribution system efficiencies must be calculated using the algorithms and equations in Appendix F of this manual for both the *Proposed Design* and the *Standard Design*. The *Standard Design* calculation must use the default values of that procedure. For non-central HVAC systems, the *Standard Design* shall have no ducts.

3.9 Infiltration/Ventilation

The intentional or unintentional replacement of conditioned indoor air by unconditioned outdoor air creates heat gains or heat losses for a conditioned building. This exchange of indoor and outdoor air occurs for all buildings to a greater or lesser extent. Mechanical ventilation gives a certain degree of control of the rate of this exchange and depending on the balancing of the ventilation may create building pressurization.

Proposed Design: As a default, ACMs shall not require the user to enter any values related to infiltration or mechanical ventilation for air quality and shall set the infiltration level to be the same as the standard design. ACMs shall allow a user to specify if they will be using diagnostic testing during building construction or if they wish to take infiltration reduction credit for an air-retarding wrap or reduced duct leakage. An air retarding wrap can qualify for a default reduction in Specific Leakage Area (SLA) of 0.50 without confirmation by diagnostic testing. The air retarding wrap must be tested and labeled by the manufacturer to comply with ASTM E1677-95, *Standard Specification for an Air Retarder (AR)*

Material or system for Low-Rise Framed Building Walls and have a minimum perm rating of 10. The air-retarding wrap must be installed per the manufacturer's specifications that must be provided to comply with ASTM E1677-95. The default infiltration (no diagnostic testing and measurement of infiltration) credit for reduced duct leakage is also an SLA reduction of 0.50. Neither of these credits may be taken if the user chooses a diagnostic testing target for reduced infiltration. Either of these prescriptive infiltration reduction credits are special features and must be listed in the *Special Features and Modeling Assumptions* listings of the CF-1R and C-2R. The air retarder specifications listed above must also be reported in the *Special Features and Modeling Assumptions* listings when an air retarder is modeled by the ACM. If the user specifies they will be using diagnostic testing during construction, for either reduced infiltration or reduced infiltration with mechanical ventilation, the ACM must require the user to choose an input menu to enter a target value for measured $CFM50_H$ or the SLA corresponding to the target $CFM50_H$, and, if mechanical ventilation is to be used, the wattage and cfm of the ventilation supply and exhaust fans. Note that when the *Proposed Design* target value for reduced infiltration falls below a value corresponding to an SLA of 3.0, mechanical ventilation is required and this requirement must be reported as described in Chapter 2. Whenever mechanical ventilation is modeled (required or not), the volumetric capacity modeled must be at least 0.047 cfm/ft^2 of conditioned floor area. This minimum capacity is needed to provide adequate ventilation for indoor air quality. If the user attempts to model total mechanical volumetric capacity (balanced + unbalanced) less than 0.047 cfm/ft^2, then the ACM must indicate an input error and automatically block compliance output.

Tested infiltration below a value corresponding to an SLA of 1.5 is not allowed unless mechanical **supply** ventilation is installed adequate to maintain the residence at a pressure greater than -5 pascals relative to the outside average air pressure with other continuous ventilation fans operating. When the user chooses diagnostic testing, the diagnostic testing shall be performed using fan pressurization of the building in accordance with ASTM E 779-1987 (Reapproved 1992), *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization* and the equipment used for this test must meet the instrumentation specifications found in Section 4.1 of Appendix F. The specifications for diagnostic testing and the target values specified above must be reported in the *HERS Required Verification* listings on the CF-1R and C-2R as described in Chapter 2.

Standard Design: The *Standard Design* does not use mechanical ventilation and assumes infiltration corresponding to an Specific Leakage Area (SLA) of 4.9 for ducted HVAC systems and an SLA of 3.8 for non-ducted HVAC systems.

Refer to Sections 4.17 and 4.17.1 for more detailed information.

3.10 Additions

Additions are treated as separate new buildings except for the determination of internal heat gains, which are specified in Section 4.5 for the purpose of determining a *Standard Design* for the addition. The modeling of additions or alterations must be reported in the *Special Features and Modeling Assumptions* listings, which must state that the building vintage~~,~~ and the input assumptions corresponding to this vintage must be verified prior to alteration to receive credit.

When an existing HVAC system is extended to serve an addition, the default assumptions for duct and HVAC distribution efficiency must be used for both the *Proposed Design* and the *Standard Design*. However, when a new, high efficiency HVAC distribution system is used to serve the addition or the addition and the existing building, that system may be modeled to receive energy credit subject to diagnostic testing and verification of proper installation by a HERS rater.

Proposed Design: The user must enter an indication that an addition is being modeled and the conditioned floor area of the addition for the *Proposed Design*. When an ACM has the capability of running an existing building plus an addition in a single pass, the addition and the existing building must be entered independently and reported independently. Special output must be created to clearly indicate existing building components separately from new components. Likewise altered existing components must have separate accounting and reporting. Existing building components must be reported exclusively in lowercase type and new or altered components exclusively in UPPERCASE type for single pass Addition with Existing Building runs or Alteration runs. ACMs that require two or more passes to model these situations do not require these restrictions on type case for existing and new (or altered) component reporting but these ACMs must clearly indicate which run corresponds to existing conditions and which run corresponds to the new or altered conditions and the *Special Features and Modeling Assumptions* listings for both runs must report that two output files, two CF-1Rs and two C-2Rs are required to be checked.

An existing building plus an addition may be modeled by means of two separate compliance runs:

The user or the ACM models the *Existing Building* and the *Addition plus the Altered Existing Building.* There will be two sets of energy use figures for each of these energy simulation runs, the predicted energy use of the modeled building (EU) and the predicted energy budget calculated based on the rules specified in this manual (EB).

Let

EU_e = the energy use of the existing building (*Proposed Design*).

EB_e = the energy budget for the existing building (*Standard Design*).

EU_{e+a} = the energy use of the altered existing building with the addition.

EB_{e+a} = the energy budget of the altered existing building with the addition.

and

A_e = the conditioned floor area of the existing building.

A_{e+a} = the conditioned floor area of the altered existing building with the addition.

$$F = \frac{A_e}{(A_{e+a})} \qquad \text{Equation 3.4}$$

The altered existing building with the addition complies with the Standards when Equation 3.5 is satisfied:

$$EU_{e+a} \le EB_{e+a} + F \times (EU_e - EB_e) \qquad \text{Equation 3.5}$$

When no water heating is proposed for the addition, the ACM must report that no water heating energy is being calculated and the energy budgets cannot reflect the use of water heating energy. When a new water heater is replacing the existing water heater for the whole dwelling, the ACM must use the existing plus addition approach to compliance with the water heater modeled with the existing building. When the specifications of the existing water heater are unknown, the water heating budget is determined as if the dwelling were all new construction.

If the addition increases the number of water heaters in the dwelling then the addition *Standard Design* must be modeled with a non-circulating, gas-fired water heater with a volume which is the lessor of the *Proposed Design* volume or 50 gallons and an Energy Factor of 0.60. If the building does not have gas service, the ACM may allow the *Standard Design* water heater to be a non-circulating electric water heater with an Energy Factor of 0.98.

Standard Design: For additions, the *Standard Design* shall have a total glazing area equal to that allowed by Package D and the conditioned floor area of the addition just as for new buildings. For the *Standard Design* the glazing orientation, U-value, and SHGC of the fenestration shall be modeled in the same manner as a new building.

When additions are modeled with an existing building, the ACM must require the user to determine and enter the vintage of the existing building. The ACM shall then use the default assumptions specified in Table 3-7 for modeling the existing structure. If the ACM allows the user to enter higher U-values, higher F2 values, higher SHGCs, lower efficiencies, or lower energy factors than the vintage defaults from Table 3-7 for the existing building's *Proposed Design*, the ACM must report such values as special features on the *Special Features and Modeling Assumptions* listings.

Table 3-7 - Default Assumptions for Existing Buildings

	Default Assumptions for Year Built (Vintage)				
Conservation Measure	**Before 1978**	**1978 to 1983**	**1984 to 1991**	**1992 to 1998**	**1999 +**
INSULATION U-VALUE					
Roof	0.076	0.047	0.047	0.047	0.047
Wall	0.386	0.096	0.096	0.088	0.088
Raised Floor -CrawlSp	0.097	0.097	0.097	0.037	0.037
Raised Floor-No CrawlSp	0.239	0.239	0.239	0.097	0.097
Slab Edge F2 =	0.76	0.76	0.76	0.76	0.76
Ducts	R-2.1	R-2.1	R-2.1	R-4.2	R-4.2
LEAKAGE					
Building (SLA)	4.9	4.9	4.9	4.9	4.9
Ducts	28%	28%	28%	28%	28%
FENESTRATION					
U-value	Use Table 1-D - Title 24, Part 6, Section 116 for all Vintages				
SHGC	Use Table 1-E - Title 24, Part 6, Section 116 for all Vintages				
Shading Dev.	Use ~~Tables 4.3 and 4.4~~Table 3-3 for all Vintages				
SPACE HEATING EFFICIENCY					
Gas Furnace (Central) AFUE	0.75	0.78	0.78	0.78	0.78
Heat Pump HSPF	5.6	5.6	6.6	6.6	6.8
Electric Resistance HSPF	3.413	3.413	3.413	3.413	3.413
SPACE COOLING EFFIC.					
All Types, SEER	8.0	8.0	8.9	9.7	9.7
WATER HEATING					
Energy Factor	0.525	0.525	0.525	0.525	0.58
Rated Input, MBH	28.0	28.0	28.0	28.0	28.0